HIGH VOLUME POLYURETHANE FOAM SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to outline the protocol for collection of air samples for organochlorine and organophosphate compounds (i.e., dioxins and polychlorinated biphenyls) using the polyurethane foam (PUF) sampling medium. The PUF sampling system is designed to simultaneously collect suspended airborne particulates and to trap airborne pesticide vapors.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, depending on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Ambient air is drawn into a covered housing then through a glass fiber filter and PUF plug by a high-flow-rate pump operating at approximately 250 liters/minute (L/m) (approximately nine cubic feet/minute [ft^3/m]). This allows total suspended particulates (TSP) to collect on the filter surface. The PUF plug allows collection of vapor which might be stripped from the particulates on the filter.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Prior to sampling, determine whether pre- and post-filter weighing is appropriate based on project needs or client requirements. In addition, obtain pre-cleaned PUF plugs from the analytical laboratory.

After sampling, the PUF plug and filter should be stored in an 8-oz. glass jar. The PUF plug should occupy the bottom portion of the jar and the filter should be folded into quarters and placed on top of the plug. The jar is then wrapped with aluminum foil (shiny side out).

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Humidity - Glass fiber filters are comparatively insensitive to changes in relative humidity; however, collected particulate matter can be hygroscopic.

Photosensitivity - PUF plugs are white and turn yellow upon exposure to light. They should be stored in a dark place (i.e., a black trash bag or a cooler) prior to and after sampling.

5.0 EQUIPMENT/APPARATUS

5.1 Sampling Media (Sorbents)

Polyurethane Foam - polyether-type polyurethane foam (density No. 3014, 0.0225 grams/cm^3, or equivalent). This is the type of foam generally used for furniture upholstery, pillows, and mattresses (General Metals Work's part number GPS-116 is recommended, three inch PUF plug, although one and two inch pieces are also available).

Glass Fiber Filter - 102-mm diameter.

5.2 Sampling Equipment

- PS-1 PUF Samplers or Equivalent (platform, legs, motor, magnehelic panel, tubing, venturi, and ball valves)
- Sample modules
- Calibration orifice
- Manometer
- Plastic bags
- Tweezers

- Aluminum foil
- Hexane
- Surgical gloves
- Solvex gloves
- Sample jars
- Trash bags
- Calibration Worksheets
- Air Sampling Worksheets (PUF)
- Logbook
- Computer or calculator to perform calculations
- Calibrated scale (if weighing is required)
- Source of electricity (AC/DC): an electrical source of 100 volts, 15 amps is required

6.0 REAGENTS

Reagents are not used for the preservation of PUF samples. Hexane is required for decontaminating PUF glassware. No other decontamination solutions are required.

7.0 PROCEDURES

7.1 Calibration of Elapsed-Time Meters and Calibration Orifices

Elapsed-Time Meter

Every six months the elapsed-time meter should be checked against a timepiece of known accuracy, either on site or in the laboratory. A gain or loss of >2 min/24-hr period warrants adjustment or replacement of the indicator. The results of these checks should be recorded in the calibration logbook.

Calibration Orifices

Upon receipt and at one-year intervals, calibration orifices should be certified with a positive displacement standard volume meter (such as a Rootsmeter) traceable to the National Bureau of Standards (NBS). This certification will be performed by the manufacturer. Calibration orifices should be visually inspected for signs of damage before each use, and they should be recalibrated if the inspection reveals any nicks or dents in the orifice.

7.2 General Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain and organize the necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, client, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry, in accordance with the site specific Health and Safety Plan.

6. Use stakes or flagging tape to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.3 Sample Module Preparation

1. Pre-clean all sampling equipment with hexane prior to use.

2. Check the lower canister to ensure that the upper and lower orange silicone gaskets are in place (Figure 1, Appendix A).

3. Using tweezers, load the glass cartridge with a pre-cleaned PUF plug, making sure the foam is evenly distributed throughout the cartridge, and install in the lower canister.

4. Screw the filter holder support onto the lower canister, after ensuring that the silicone rubber gasket is in place.

5. Screw the filter holder with support screen onto the filter holder support, after ensuring that the silicone rubber gasket is in place.

6. Install the lower Teflon gasket in the filter holder.

7. Using tweezers to handle the filter, place glass fiber filter (rough side up) into the filter holder.

8. Install the upper Teflon gasket.

9. Ensure that the silicone rubber gasket is present and then install the filter retaining ring and tighten the swing bolts.

10. Ensure that all fittings are snug, yet not overtight (Overtightening will distort the gaskets.).

11. Cover the sample module with the metal cover and place in a cooler.

12. Assemble a field blank in the same manner and store in the same cooler.

It is recommended that two sampling modules are prepared for each sampling system so that the filter and PUF plug exchange may take place in the clean zone. The second set of modules is used for the subsequent sampling round.

7.4 Field Calibration of the Sampler

Calibration of the PUF sampler is performed *without* a PUF plug and *without* the glass fiber filter in the sampling module. However, the empty glass cartridge *must remain* in the module to ensure a good seal through the module.

Calibration of the PUF sampler is performed prior to using the sampling system in the field and after repair or replacement of major components of the sampling system (i.e., motor repair).

1. Assemble the sample module, as described in Section 7.2, without the PUF plug and without the glass fiber filter.

2. Assemble the sampling system by attaching the legs and the magnehelic panel to the platform. Connect the motor to the platform, making sure that the gasket is placed between the motor and the platform.

3. Plug the motor into the timer located on the magnehelic panel.

4. Connect the magnehelic to the venturi with tubing.

5. Place the sampling module into the quick-release fitting and engage by locking the two levers down securely.

6. Connect the calibration orifice to the sample module (Figure 2, Appendix A). Ensure that no

leaks exist between the orifice unit and the sampler.

7. Fill the manometer with colored water and connect it to the calibration orifice pressure tap with tubing.

8. Set the manometer to "zero" as shown in Figure 3 (Appendix A). This is done by sliding the scale either up or down so the "zero" is level with the bottom of the meniscuses.

9. Connect the sampling system to the power source and fully open the ball valve by pushing the red lever up to the "on" position.

10. Fully open the voltage variator by using a screwdriver to turn the screw on the magnehelic gauge panel clockwise.

11. Operate the sampling system for at least 15 minutes to establish thermal equilibrium prior to calibration.

12. Conduct a five point calibration in the range of the desired flow rate as follows:

    a. Adjust the voltage variator (located on the magnehelic gauge panel) and/or the ball valve to obtain a reading of 70 (arbitrary) inches on the magnehelic gauge.

    b. The magnehelic gauge number, 70, is pre-recorded on the Field Calibration Work Sheet (Column #5, Attachment 1, Appendix B). Read and record (Column #4 on the Field Calibration Work Sheet) the total distance between the two meniscuses on the manometer (Figure 3, Appendix A). This is a measure of the pressure drop across the calibration orifice.

    c. Move the ball valve (red lever) to adjust the magnehelic gauge down to 60 (arbitrary) inches. Let the sampler run for at least two minutes to re-establish the run temperature conditions. Repeat step 12 b.

d. Using the above procedure (steps 12 b. and c.), adjust the ball valve for readings at 50, 40, and 30 inches.

13. Measure the barometric pressure and ambient temperature.

14. Record all data on the Field Calibration Work Sheet (Attachment 1, Appendix B). Perform calculations as described in Sections 8.1, 8.2, 8.3, and 8.4 of this SOP and record the appropriate results on the Field Calibration Work Sheet.

15. Adjust the ball valve to the magnehelic reading required to achieve the target volumetric flow rate as requested by the Work Assignment Manager.

7.5 Sampling

1. Verify that the sampler has been calibrated as described in Section 7.4.

2. Transport the sampler to the desired location. The PUF sampler must be operated in the breathing zone or it may be elevated. The sampler should be located in an unobstructed area, at a distance of twice the height of any obstruction to air flow, if possible, but no closer than two meters to the obstacle. In urban or congested areas, it is recommended that the sampler be placed on the roof of a single story building.

3. If it is not already set up, assemble the sampling system as described in Section 7.4 (Steps 2 to 4). Adjust the exhaust hose so that it faces downwind of the sampler.

4. Put on clean surgical gloves.

5. Place the loaded sampling module into the quick release fitting and engage by locking the two levers down securely. Refer to Figure 4 (Appendix A) for the complete set-up of the sampling system.

6. Remove the metal cover.

7. Record the following information on the Air Sampling Worksheet (Attachment 2, Appendix B): high volume pump number, direction from site, location, sample start time, time/counter (start).

8. Plug in the unit.

9. If necessary adjust the magnehelic gauge to the reading required to achieve the target flow rate by turning the ball valve.

10. Wait approximately two minutes for the magnehelic reading to stabilize.

11. Allow the sampling system to operate for the duration determined by the Work Assignment Manager.

12. If the sampling system is to be in use for an extended period of time (i.e., the duration of sampling is greater than 24 hours), the initial calibration should be audited every 24 hours. This audit is accomplished by checking one point in the calibration curve using the field calibration procedure described in Section 7.4 and using a fully assembled sample module *with* the PUF plug and glass fiber filter installed. If the result of this check is greater than ±7% of the initial calibration value, the sampling system must be recalibrated.

7.6 Unit Shutdown and Sample Collection

1. Record the following information on the Air Sampling Worksheet (Attachment 2, Appendix B): sample stop time, time/counter (stop), the ending magnehelic reading, and whether or not there was a pump fault. Measure the ambient temperature and barometric pressure at the end of the sampling period. This information and the ending magnehelic gauge reading should be recorded on the Field Calibration Work Sheet.

2. Unplug the sampler and remove the sample module.

3. Cover the sample module with the metal cover. Keep the sample module in a vertical position at all times.

4. Place the sample module in a cooler for transport back to the command post. The field blank should also be stored in the same cooler.

5. If additional sampling is scheduled, perform a field calibration audit as described in Section 7.5, #12. The unit must be decontaminated with hexane and chem wipes prior to initiating additional sampling activities. Install a new sampling module and begin sampling as described in Section 7.5. If no additional sampling is scheduled, secure the unit.

6. Wearing surgical gloves and using tweezers, remove the PUF plug and place it in a clean 8-oz. glass jar. Fold the glass fiber filter into quarters and place it on top of the PUF plug. Label the jar appropriately and cover it with aluminum foil (shiny side out). Prepare the sample for transport to the laboratory for analysis, as necessary.

7. Calculate the post-sampling flow rate, the average flow rate, and the total volume sampled (Sections 8.5 and 8.6).

8.0 CALCULATIONS

The total volumes calculated for each sampling unit are corrected to standard conditions (760 millimeters of mercury [mm Hg] and 298 kelvin [K]). This is necessary for reporting the concentrations in a manner consistent with method requirements. The first step in the calibration process is to determine the slope (m) and the y-axis intercept (b) from the Factory Calibration Work Sheet. This is based on the formula y=mx+b. This is calculated either graphically (5-point calibration curve) or by a regression analysis of the data provided on the Factory Calibration Work Sheet. Once the slope and intercept are calculated for the factory calibration data, a calibration curve is developed for each of the sampling units. The important data elements needed to complete this task are the pressure drop readings for each of the arbitrary values (I) (Section 7.4), ambient temperature and ambient pressure. ***If the sampling unit calibration results will be provided in mm Hg instead of inches of water, then Section 8.1 may be skipped because the manufacturer has already calculated the slope (m) and intercept (b) and provided them on the Factory Calibration Work Sheet. This information should be recorded in the appropriate location on the Field Calibration Work Sheet.***

8.1 Determining the Slope (m) and Y-Axis Intercept (b) of the Factory Calibration

1. Obtain the current Factory Calibration Work Sheet from manufacture's calibration kit or Air Team Calibration File. See Figure 5 (Appendix A) for an example.

2. Copy columns #6 & #7 from the Q_{std} section of the Factory Calibration Work Sheet to column #1 & #2, respectively, on the Field Calibration Work Sheet (Attachment 1, Appendix B). Record the ambient temperature, ambient pressure at which the factory orifice calibration was performed, and orifice serial number from the Factory Calibration Work Sheet in the respective locations on the Field Calibration Work Sheet. Return the Factory Calibration Work Sheet to the calibration kit or the proper file.

3. Solve the following formula for every calibration orifice static pressure found in column #1 of the Field Calibration Work Sheet. Record results in column #3 of the Field Calibration Work Sheet. The units of the results are arbitrary. There should be at least five computations.

   Equation:

   y-axis equation orifice = $[\triangle H(P_a/760)(298/T_a)]^{1/2}$

   Where:

   $\triangle H$ = Calibration orifice static pressure in inches of water ("H_2O) (Field Calibration Work Sheet, column #1).
   P_a = Ambient pressure at which the factory orifice calibration was performed in mm Hg.
   T_a = Ambient temperature at which the factory orifice calibration was performed in K.

Example:

$\triangle H$ = 2.0 "H_2O, P_a = 760.5mm Hg, T_a = 295 K

y-axis equation orifice = [(2.0 "H_2O)(760.5mm Hg/760 mm Hg)(298 K/295 K)]$^{1/2}$

y-axis equation orifice = [2.02]$^{1/2}$

y-axis equation orifice = 1.42

4. Graph the results in column #2 of the Field Calibration Work Sheet on the x-axis against the data presented in column #3 of the Field Calibration Work Sheet on the y-axis or perform a regression analysis of the data to determine the slope and (m) and the y-axis intercept (b). Record in the appropriate location on the Field Calibration Work Sheet.

Example: Regression analysis from Lotus 123:

Regression Output:

Constant	- 0.03
Std Err of Y Est	0.00246358
R Squared	0.99999508
No. of Observations	6
Degrees of Freedom	4

X Coefficient(s)	9.52
Std Err of Coef.	0.01055231

Where:

Constant = y-Axis intercept (b)
X Coefficient(s) = Slope (m)

8.2 Determining the Slope (m) and a Y-Axis Intercept (b) of the Field Calibration

1. Obtain pressure drop readings from the water manometer and the matching arbitrary magnehelic values (I = 70, 60, 50, 40, 30) from Section 7.4 and record the data on a Field Calibration Work Sheet in columns #4 and #5, respectively. Record the ambient temperature and ambient pressure at which each unit calibration was performed.

2. Solve the y-axis equation using the formula below and using the data found in column #4 on the Field Calibration Work Sheet. Record the results in column #6 of the Field Calibration Work Sheet. The units of the results are arbitrary. There should be at least five computations.

Equation:

y-axis equation sampling unit = $[\triangle H(P_a/760)(298/T_a)]^{1/2}$

Where:

$\triangle H$ = Static pressure of the sampling unit in "H_2O (column #4 of the Field Calibration Work Sheet).
P_a = Ambient pressure in mm Hg at time of unit calibration.
T_a = Ambient temperature in K at time of unit calibration.

Example:

$\triangle H$ = 6.0 "H_2O, P_a = 756.92mm Hg, T_a = 295 K

y-axis equation sampling unit = [(6.0 "H_2O)(756.92 mm Hg/760 mm Hg)(298 K/295 K)]$^{1/2}$

y-axis equation sampling unit = [6.06]$^{1/2}$

y-axis equation sampling unit = 2.46

3. Determine the volumetric flow rate (Q_{STD}) for each calibration point using the following equation. Record the results in column #7 of the Field Calibration Work Sheet.

Equation:

$$QSTD = 1/m\,[\{\triangle H(P_a/760)(298/T_a)\}^{1/2} - b]$$

Where:

m = Slope from the Factory Calibration Work Sheet graph or regression analysis (Step #4, Section 8.1).
$\triangle H$ = Pressure drop in "H_2O recorded on Field Calibration Work Sheet (column #4).

P_a = Ambient pressure in mm Hg at time of field calibration.
T_a = Ambient temperature in K at time of field calibration.
b = y-Axis intercept from the Factory Calibration Work Sheet graph or regression analysis (Step #4, Section 8.1).

Example:

m = 9.52, $\triangle$H = 6.0 "H_2O, P_a = 756.92 mm Hg, T_a = 295 K, b = - 0.03

Q_{STD} = 1/9.52 [{6.0 "H_2O (756.92 mm Hg/760 mm Hg)(298 K/295 K)}$^{1/2}$ -(-0.03)]

Q_{STD} = 1/9.52 [2.46]

Q_{STD} = 0.26 m^3/min

4. Determine the Y_{value} for each calibration point. Record in column #8 on the Field Calibration Work Sheet. The units of the results are arbitrary.

Equation:

Y_{value} of each calibration point = $[I(P_a/760)(298/T_a)]^{1/2}$

Where:

I = Arbitrary value located in column #5 on the Field Calibration Work Sheet.
P_a = Ambient pressure in mm Hg at time of unit field calibration.
T_a = Ambient temperature in K at time of unit field calibration.

Example:

I = 70, P_a = 756.92 mm Hg, T_a = 295 K

Y_{value} of each calibration point = [70(756.92mm Hg/760 mm Hg)(298 K/295 K)]$^{1/2}$

Y_{value} of each calibration point = 8.39

5. Graph the results in column #7 of the Field Calibration Work Sheet on the x-axis against the data presented in column #8 from the Field Calibration Work Sheet on the y-axis or perform a regression analysis to determine the slope (m) and the y-axis intercept (b). Record in the appropriate location on the Field Calibration Work Sheet.

Example: Regression analysis from Lotus 123:

Regression Output:	
Constant	1.64
Std Err of Y Est	0.057770455
R Squared	0.998738313
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	25.66
Std Err of Coef.	0.45593301

Where:

Constant = y-axis intercept (b)
X Coefficient(s) = Slope (m)

8.3 Checking the Linearity of the Calibration

1. Calculate Y_{cal} to determine if the calibration is within the limits of linearity (±5%) using the following formulas. Record the results in column #9 of the Field Calibration Work Sheet.

Equation: $Y_{cal} = mQ_{STD} + b$

Where:

m = Slope of the field calibration curve from the regression analysis of columns #7 & #8.
Q_{STD} = Volumetric flow rate calculated on the Field Calibration Work Sheet (column #7).
b = y-Axis intercept of the field calibration curve from the regression analysis of columns #7 and #8.

Example:

m = 25.66, Q_{STD} = 0.26, b = 1.64

Y_{cal} = [(25.66)(0.26)] + 1.64

Y_{cal} = 8.31

2. Calculate %-difference of the Y_{value} and Y_{cal}. Record the results in column #10 of the Field Calibration Work Sheet. If the results are not with in ±5% recheck your calculations or recalibrate.
Equation:

%-difference = ((Y_{value} - Y_{cal})/Y_{cal})(100)

Where:

Y_{value} = Y_{value} in column #8 of the Field Calibration Work Sheet.
Y_{cal} = Value from previous calculation recorded in column #9 of the Field Calibration Work Sheet.

Example:

%-difference = ((8.39 - 8.31)/8.31)100

%-difference = 0.96%

8.4 Determining Pre-Sampling Volumetric Flow Rate

1. Determine the volumetric flow rate at each calibration point using the following equation and recording the data in column #11 of the Field Calibration Work Sheet.

Equation:

$Q = (1/m)[\{I(P_a/760)(298/T_a)\}^{1/2} - b]$

Where:

I = Arbitrary magnehelic reading recorded on Field Calibration Work Sheet (column #5).
P_a = Ambient pressure in mm Hg at which the sampling unit was calibrated.
T_a = Ambient temperature in K at which the sampling unit was calibrated.
b = y-Axis intercept from the field calibration graph or regression analysis of columns #7 & #8.
m = Slope from the field calibration curve graph or regression analysis of columns #7 & #8.

Example:

I = 70, P_a = 756.92 mm Hg, T_a = 295 K, m = 25.66, b = 1.64

$Q = (1/25.66)[\{70(756.92\text{mm Hg}/760\text{mmHg})(298\text{ K}/295\text{ K})\}^{1/2} - 1.64]$

Q = 0.26 m^3/min

2. Determine the arbitrary set point for a target volumetric flow rate, as follows.

a. Obtain the target volumetric flow rate in m^3/min from the Work Assignment Manager.

b. Obtain the ambient barometric pressure and the ambient temperature at the start of the sampling event and record on the Field Calibration Work Sheet.

c. Using the following equation calculate your arbitrary set point for each sampler. Record in the appropriate location on the Field Calibration Work Sheet.

Equation:

$I = [\{(Q_{target})(m)\} + b]^2 / [(P_a/760)(298/T_a)]$

Where:

Q_{target} = Desired volumetric flow rate (m^3/min.)
m = Slope of the field calibration as determined by the regression of columns #7 & #8.
b = y-Axis intercept of the field calibration as determined by the regression of columns #7 & #8.
P_a = Ambient pressure at which the sample is being taken (mm Hg)
T_a = Ambient temperature at which the sample is being taken (K)

Example:

What is the magnehelic set point (I) for the target flow rate of 0.25 m^3/min.?

m = 25.66, b = 1.64, P_a = 756.92 mm Hg, T_a = 295 K

$$I = [(0.25 m^3/min.)(25.66)+1.64]^2/[(756.92/760)(298/295)]$$

$$I = 64.49$$

3. Determine the initial flow rate, as follows.

a. Set the magnehelic set point (I) as determined by the previous step.

b. Use the following equation to check the set point to determine if is the correct set point for the desired flow rate.

Equation:

$Q = (1/m)[\{I(P_a/760)(298/T_a)\}^{1/2} - b]$

Where:

Q = Volumetric flow rate at set point (I).
I = Magnehelic set point (I).
P_a = Ambient pressure at the start of the sampling event.
T_a = Ambient temperature in K at the start of the sampling event.
b = y-Axis intercept from the field calibration graph or regression analysis of column #7 & #8.
m = Slope from the field calibration curve graph or regression analysis of column #7 & #8.

Example:

I = 64.49, P_a = 756.9mm Hg, T_a = 295 K, m = 25.66, b = 1.64

$Q = 1/25.66[\{64.49(756.9\text{mmHg}/760\text{mmHg})(298\text{ K}/295\text{ K})\}^{1/2} - 1.64]$

Q = 0.25 m^3/min.

8.5 Determining Post-Sampling Volumetric Flow Rate

1. Obtain the ambient barometric pressure and the ambient temperature at the end of the sampling event and record on the Field Calibration Work Sheet.

2. Obtain the set point (I) of the magnehelic at the end of the sampling event and record on the Field Calibration Work Sheet.

3. Use the following equation to determine the volumetric flow rate.

Equation:

$Q = (1/m)[\{I(P_a/760)(298/T_a)\}^{1/2} - b]$

Where:

Q = Volumetric flow rate at set point (I).
I = Magnehelic set point (I) at the end of the sampling event.
P_a = Ambient pressure at the end of the sampling event.
T_a = Ambient temperature in K at the end of the sampling event.
b = y-Axis intercept from the field calibration graph or regression analysis of columns #7 & #8.
m = Slope from the field calibration curve graph or regression analysis of columns #7 & #8.

Example:

I = 50, P_a = 758.9 mm Hg, T_a = 299 K, m = 25.66, b = 1.64

$Q = 1/25.66)[\{50(758.9\text{mmHg}/760\text{mm Hg})(298\text{ K}/299\text{ K})\}^{1/2} - 1.64]$

Q = 0.21 m^3/min.

8.6 Determining Total Volume

Average the pre- and post-volumetric flow rates and multiply by the time sampled to determine the volume sampled. Record all information on the Field Calibration Work Sheet.

Example:

$((0.25m^3/\text{min} + 0.21m^3/\text{min})/2)480\text{ min} = 110.4\text{ m}^3$

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Provide one field blank per sampling period or one field blank for every 20 samples, whichever is greater. A field blank is treated exactly as a sample except that air is not drawn through the media. PUF plugs should be submitted to the laboratory for cleaning prior to field sampling. If the PUF plugs were cleaned in house, one or two clean plugs should be sent to the laboratory which will be analyzing the samples. Sample spiking may be necessary for pesticide and PCB samples; consult with the Work Assignment Manager.

10.0 DATA VALIDATION

Results of the quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials follow U.S. EPA, OSHA, and corporate health and safety practices.

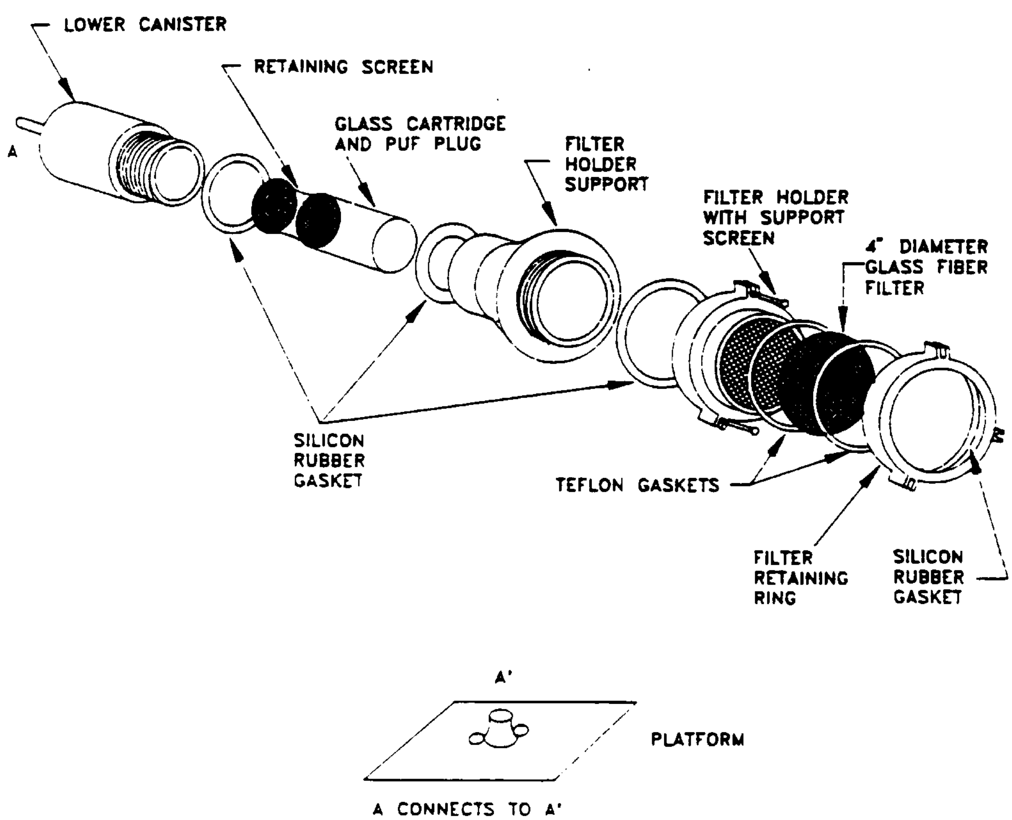
12.0 REFERENCES

Method TO4, Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air, Revision 1.0, April, 1984.

APPENDIX A

Figures

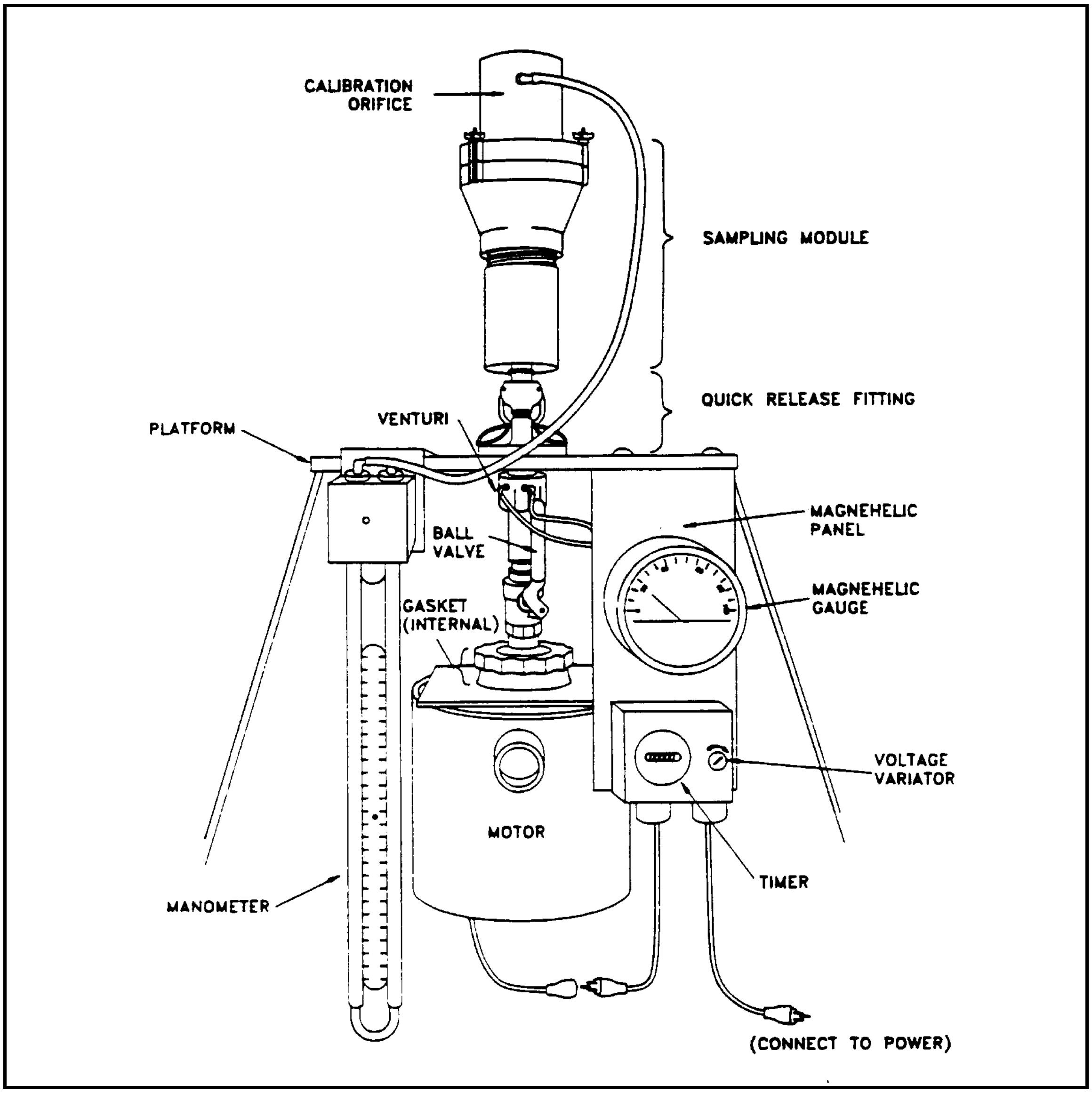
FIGURE 1. Sample Module



APPENDIX A (Cont'd)

Figures

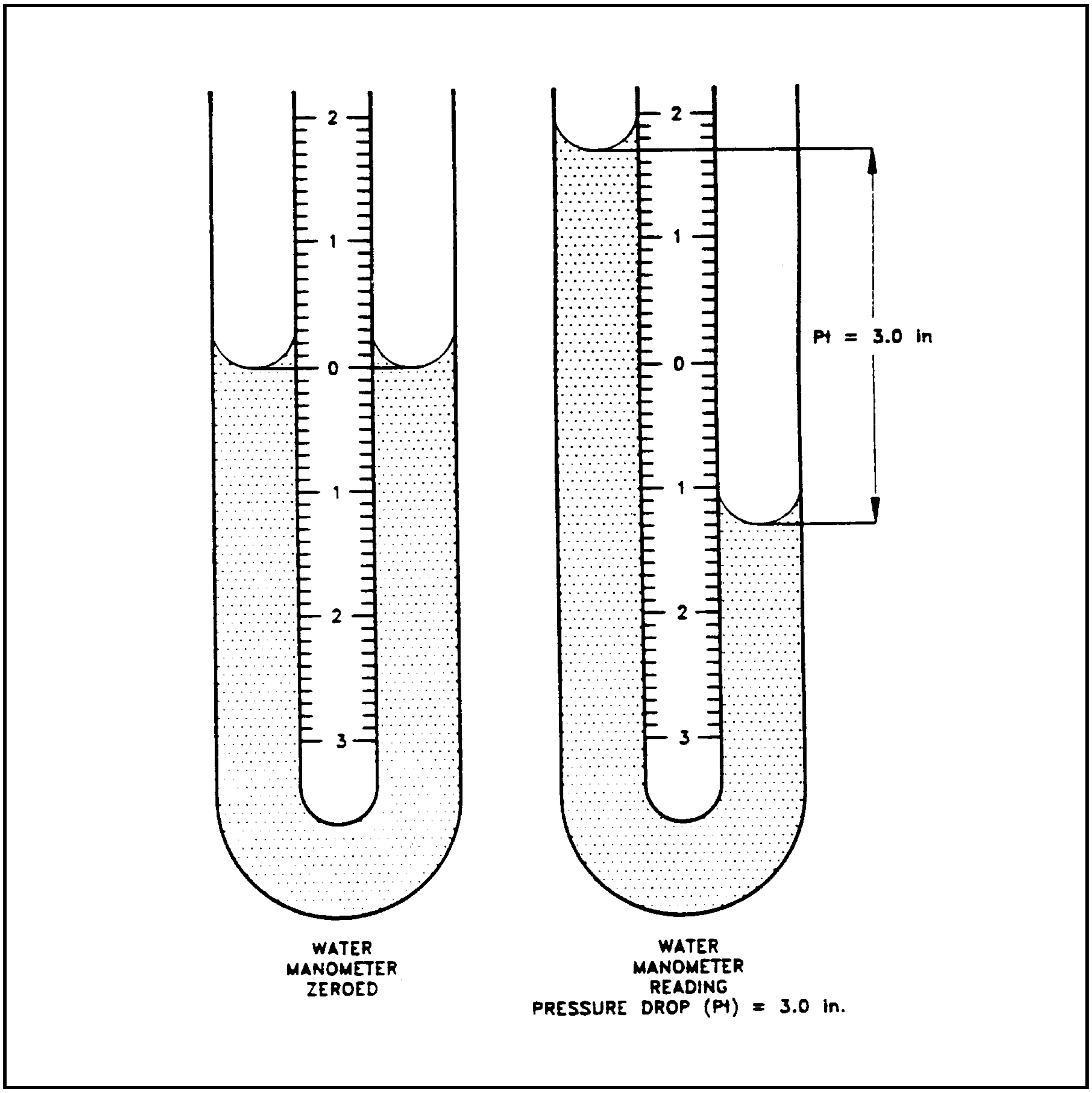
FIGURE 2. Calibration of the PUF Sampler



APPENDIX A (Cont'd)

Figures

FIGURE 3. Manometer



APPENDIX A (Cont'd)

Figures

FIGURE 4. PUF Sampler

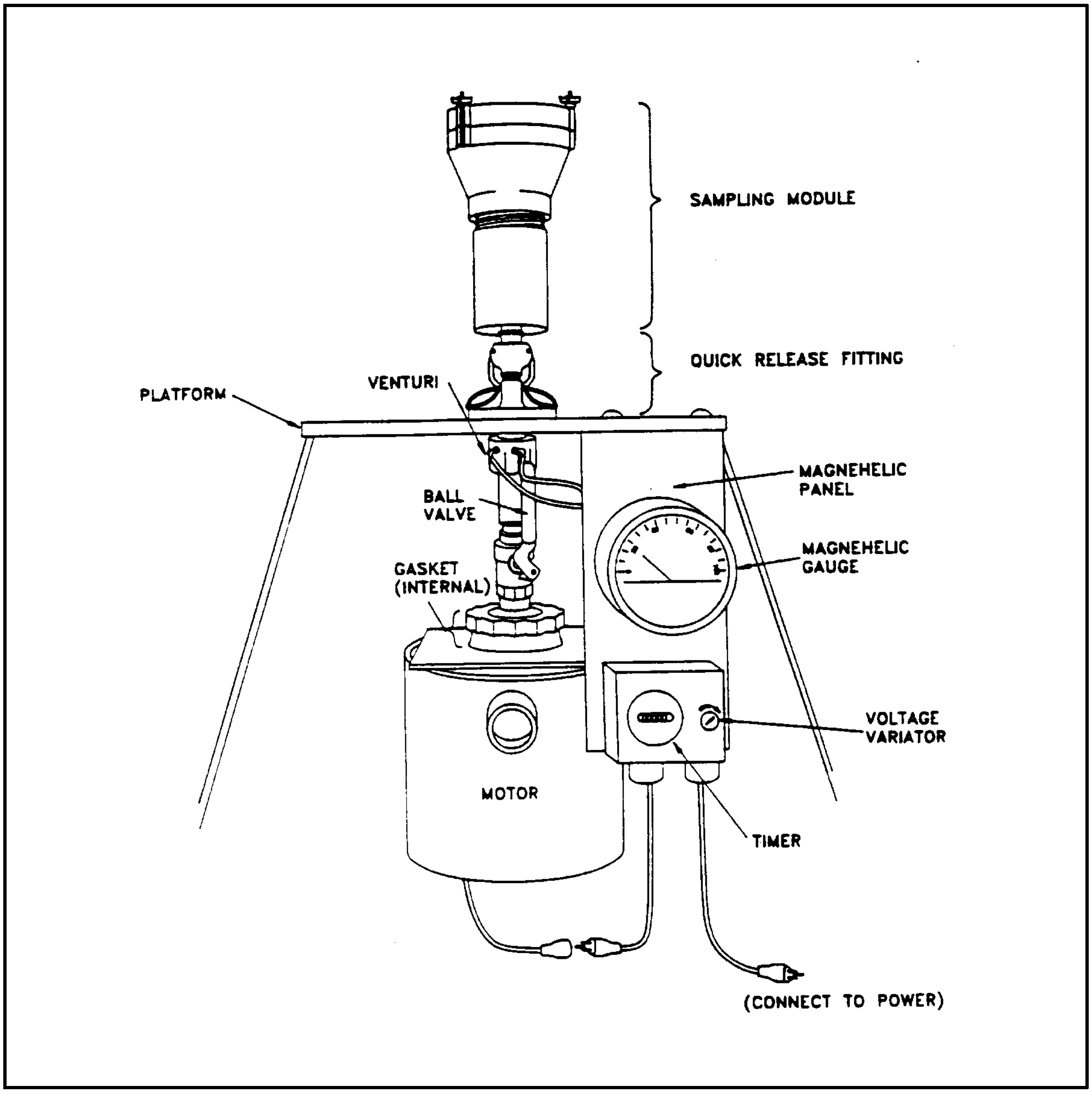


FIGURE 5. Factory Calibration Work Sheet

GRASEBY/ GMW
145 South Miami Avenue
Cleves, OH 45002
Tel. (513) 941-2229

High Volume Orifice Calibration Certificate

Pa: 748.8 mm of Hg	Roots Meter Serial No.: 7509364	Calibration Performed by: S.BUTLER
Ta: 22.0 °C	Calibrator Orifice Model No.: 40A	Calibration Date: 29SEP94
RH: 57 %	**Calibrator Orifice Serial No.: 77C**	Date placed in service:______________

Q Standard Calibration Data

(1) Run Point No.	(2) Elapsed Time-Δt Min.	(3) Initial Volume VM M^3	(4) Meter Inlet Static Pressure-ΔP mm of Hg	(5) Standard Volume Vstd M^3	(6) Calibrator Orifice Static Y Pressure-ΔH in. of H_2O	(6) mm of Hg	(7) X Metric Flow Rate Qstd M^3/min.	(8) English Flow Rate Qstd ft^3/min.	(9) Y $\sqrt{\Delta H \left(\frac{Pa}{760}\right)\left(\frac{298.18}{Ta}\right)}$
1	6.434	1	3.3	0.991	2.0	3.74	0.154	5.4	1.411
2	3.898	1	9.7	0.982	5.5	10.27	0.252	8.9	2.340
3	3.126	1	15.1	0.975	8.5	15.87	0.312	11.0	2.909
4	2.661	1	20.6	0.968	11.5	21.48	0.364	12.8	3.383
5	2.355	1	26.0	0.961	14.5	27.08	0.408	14.4	3.799
6	2.203	1	29.6	0.956	16.5	30.82	0.434	15.3	4.052

Slope(m): 9.41 Intercept(b): -0.035310 Correlation Coefficient(r): 0.999985

Q Actual Calibration Data

(1) Run Point No.	(2) Elapsed Time-Δt Min.	(3) Initial Volume VM M^3	(4) Meter Inlet Static Pressure-ΔP mm of Hg	(5a) Actual Volume Va M^3	(6) Calibrator Orifice Static Pressure-ΔH in. of H_2O	(6) mm of Hg	(7a) X Metric Flow Rate Qa M^3/min.	(9a) Y $\sqrt{\Delta H \left(\frac{Ta}{Pa}\right)}$
1	6.434	1	3.3	0.996	2.0	3.74	0.155	0.888
2	3.898	1	9.7	0.987	5.5	10.27	0.253	1.472
3	3.126	1	15.1	0.980	8.5	15.87	0.314	1.831
4	2.661	1	20.6	0.973	11.5	21.48	0.366	2.129
5	2.355	1	26.0	0.966	14.5	27.08	0.410	2.391
6	2.203	1	29.6	0.961	16.5	30.82	0.436	2.550

Slope(m): 5.89 Intercept(b): -0.021285 Correlation Coefficient(r): 0.999985

Equations:

$$Vstd(5) = Vm(3)\,\frac{(Pa-\Delta P)\ Tstd}{Pstd \times Ta} \qquad Qstd = \frac{Vstd}{\Delta t}$$

$$Va(5a) = Vm(3)\,\frac{(Pa-\Delta P)}{Pstd} \qquad Qa = \frac{Vstd}{\Delta t}$$

Standard Conditions:

Tstd= 25°C= 298.18°K
Pstd= 760mm of Hg

For additional information consult:

1. The Federal Register, Vol.47, No. 234, pp. 54896-54921, December 6, 1982.
2. Quality Assurance Handbook, Vol.II (EPA 600/4-77-277a), Section 2.11.
3. Graseby/GMW/Andersen Instruction Manual.

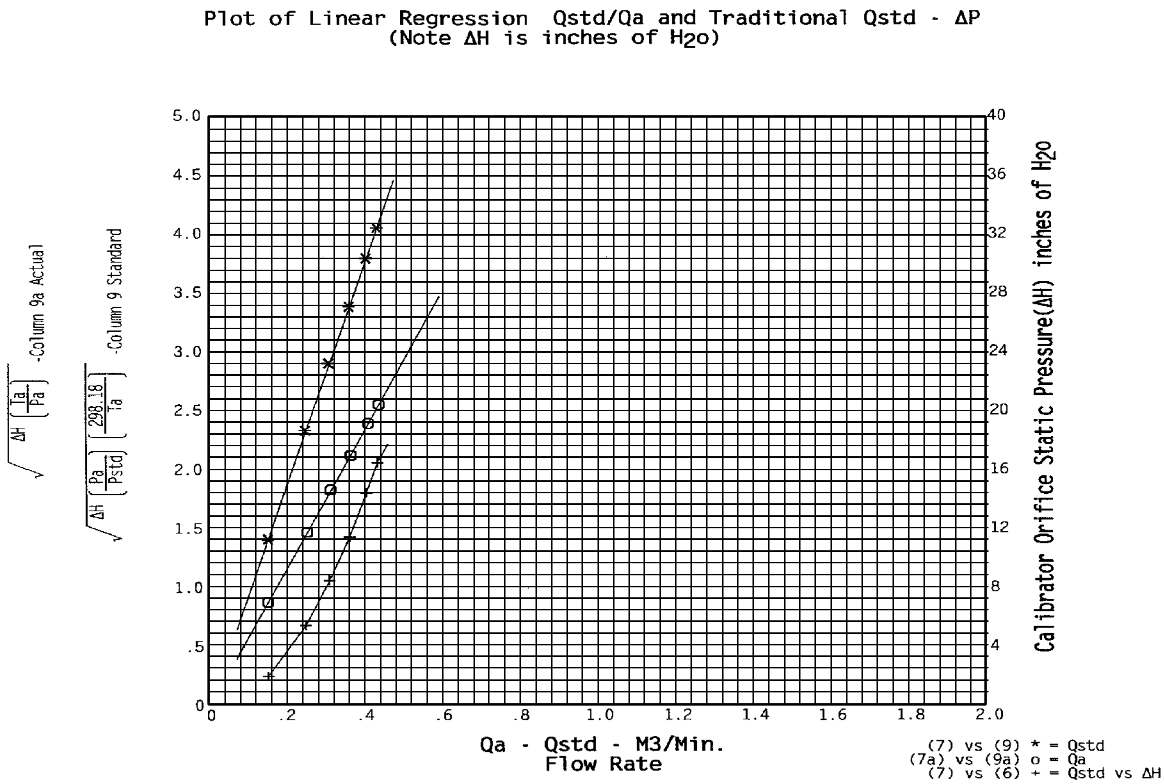
Notes:

1. EPA recommends calibrators should be recalibrated after one year of field use.

APPENDIX A (Cont'd)

Figures

FIGURE 5. Factory Calibration Work Sheet (Cont'd)



Use of Curve for determining Qa or Qstd.

To find Qa calculate:

$$Qa = \left[\frac{\Delta H \ Ta}{Pa} \right]^{1/2}$$

To find Qstd calculate:

$$Qstd = \left[\Delta H \frac{Pa}{760} \bullet \frac{298.18}{Ta} \right]^{1/2}$$

Where:
ΔH= Calibrator Manometer Reading in inches of water.
Ta= Actual Absolute Temperature in degress Kelvin(°K).
Pa= Actual Barometric Pressure in millimeters(mm) of Mercury(Hg).
b = Intercept
m = Slope

To find Qa or Qstd by Calculation.

To determine Qa calculate:

$$Qa = \frac{\left[\frac{\Delta H \ Ta}{Pa} \right]^{1/2} - b}{m}$$

To determine Qstd calculate:

$$Qstd = \frac{\left[\Delta H \frac{Pa}{760} \bullet \frac{298.18}{Ta} \right]^{1/2} - b}{m}$$

APPENDIX B

Attachments

ATTACHMENT 1. Field Calibration Work Sheet

ENVIRONMENTAL RESPONSE TEAM
HIGH VOLUME SAMPLER FIELD CALIBRATION WORK SHEET

Page ___ of ___

Site: ______________ WA#: ______________ Date: ______________

Samplers: ______________ EPA/ERT WAM: ______________ REAC TL: ______________

Sampler #: ______________ Location/Station: ______________

ORIFICE CALIBRATION INFORMATION
(Obtained from the Factory Calibration Work Sheet)

Ambient Pressure (mmHg): ______________ Ambient Temperature (kelvin): ______________ Serial #: ______________

Unit Calibration Information

Ambient Pressure (mmHg): ______________ Ambient Temperature (kelvin): ______________

Calibration Data			Calibration Curve					Linearity of Calibration Curve		
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Calibrator Orifice Static Pressure (ΔH)	Metric Flow Rate Q_{std} (m^3/min) (x-axis)	y-axis Equation Orifice	Δ H Sampling Unit ("H_2O)	Pressure Indicator of the Sampling Unit (I) (arbitrary)	y-axis Equation of the Sampling Unit	Q_{std} Orifice Calibration (x-axis)	y-value of Each Calibration Point (y-axis)	y-cal	% Difference (+/- 5%)	Flow Rate for Each Calibration Point

Slope (m) and y-intercept (b) of columns #2 & #3

m = __________ b = __________

Slope (m) and y-intercept (b) of columns #7 & #8

m = __________ b = __________

APPENDIX B (Cont'd)

Attachments

ATTACHMENT 2. Air Sampling Worksheet

ENVIRONMENTAL RESPONSE TEAM
HIGH VOLUME AIR SAMPLING WORK SHEET

Page ___ of ___

Site: ______________________ WA#: ______________________

Samplers: ______________________ EPA/ERT WAM: ______________________

Date: ______________________ REAC Task Leader: ______________________

Sample #					
Location					
Sampler ID					
Media					
Analysis/Method					
Time/Counter (Start)					
Time/Counter (Stop)					
Total Time					
Ambient Temperature (kelvin) Start					
Ambient Barometric Pressure (mmHg) Start					
Ambient Temperature (kelvin) Stop					
Ambient Barometric Pressure (mmHg) Stop					
Magnehelic Reading (Pre)					
Magnehelic Reading (Post)					
Flow Rate (Pre)					
Flow Rate (Post)					
Flow Rate (Average)					
Volume					

MET Station On-site? Y / N

General Comments: